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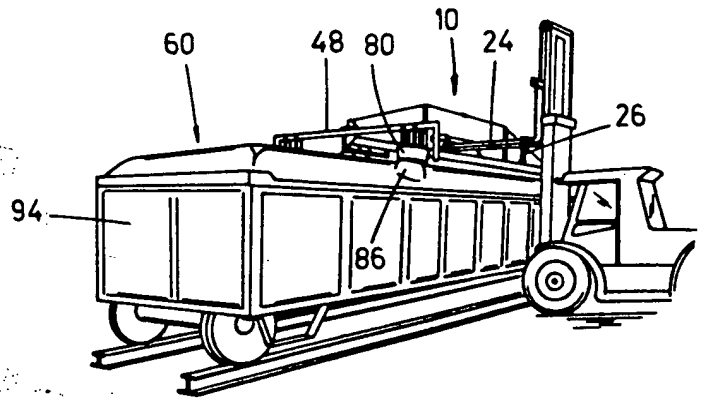
PACI- ★ Q38 F3326B/25 ★CA 1055-989

Lifting appts. for elongated rail car covers - has shift frame slidably mounted on carriage supported on vehicle

PACIFIC COAST TERMI 04.10.76-CA-262591

(05.06.79) B66f-09/18

The lifting appts. is for placing an elongated cover on an open top rail car and removing a cover from it. It comprises a carriage mountable on a movable vehicle operable to raise and lower the carriage. A shift frame is slidably mounted on the carriage for transverse sliding movement relative to it. A device effects the transverse sliding movement of the shift frame relative to the carriage.



An elongated lift frame suspended from the shift frame extends transversely from it. The lift frame has a device for engaging an elongated rail car cover to enable the cover to be raised and lowered by raising and lowering respectively of the carriage by the movable vehicle.

4.10.76 as 262591 (16pp912)

(11) (A) N. 1055989

(45) ISSUED 790605

(52) CLASS 294-50
C.R. CL.

(51) INT. CL. [2] B66F 9/18

(19) (CA) **CANADIAN PATENT** (12)

(54) LIFTING APPARATUS FOR ELONGATED RAIL CAR COVERS

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(21) APPLICATION No. 262,591

(22) FILED 761004

(30) PRIORITY DATE

No. OF CLAIMS 11

This invention relates to lifting apparatus for placing an elongated cover on an elongated open top rail car and removing a cover therefrom.

In the railway transportion of material such as ore concentrates in open top rail cars, it is desirable to protect the material against loss or damage by providing the cars with covers. In particular, it is essential that lead ore concentrates be protected against atmospheric moisture to avoid exceeding the Transportable Moisture Limit as defined in the Code of Safe Practice for Bulk Cargoes. Open top rail cars in which such material is transported are large, for example, about 50 feet long and about 10 feet wide. Multiple section covers, although easier to handle in a section-by-section manner, are not generally satisfactory and one piece covers are preferred. The connection of the separate sections of a multiple section cover to provide moisture-tight joints is a time consuming operation. On the other hand, the size of a one-piece cover makes placement and removal by conventional equipment difficult. For example, if a conventional overhead crane is used, accurate positioning of such a crane over a rail car cover is difficult, as also is the movement of a cover from one place to another. One piece covers frequently become broken with such manoeuvring, particularly if a strong wind is blowing.

It is therefore an object of the invention to provide lifting apparatus which enables one piece covers to be readily placed on and removed from elongated open top rail cars.

According to the invention, lifting apparatus for placing an elongated cover on an elongated open top rail car and removing a cover therefrom comprises a carriage mountable

on a movable vehicle operable to raise and lower the carriage, a shift frame slidably mounted on the carriage for transverse sliding movement relative thereto, means for effecting said transverse sliding movement of the shift frame relative to the carriage, and an elongated lift frame suspended from the shift frame and extending transversely thereof, said lift frame having means for engaging an elongated rail car cover to enable the cover to be raised and lowered by raising and lowering respectively of the carriage by the movable vehicle.

With the lifting apparatus of the present invention, the lift frame can be easily and accurately aligned with a cover on the rail car or at a storage position by combination of movement of the vehicle and movement of the shift frame relative to the carriage. Similarly, the cover carried by the lift frame can be easily and accurately aligned with the open top of a rail car. Further, the lifting apparatus is relatively inexpensive, and is preferably constructed so that a fork-lift truck can be used as the movable vehicle, with the carriage of the lifting apparatus being mountable on the forks of the fork-lift truck. Also, the lifting apparatus is preferably constructed so that, during handling of the cover by the apparatus, movement of the cover relative to movement of the lifting apparatus is restrained. Consequently, the risk of damage by strong wind or movement of the vehicle carrying the cover over uneven ground is small.

The elongated lift frame may be suspended from the shift frame by flexible suspension elements permitting a limited amount of relative movement between the lift frame and the shift frame. The flexible suspension elements are preferably short so that the limited amount of movement of the lift frame relative to the shift frame is only sufficient to permit final alignment of the lift frame with the car cover after

initial positioning of the movable vehicle as hereinafter explained.

Advantageously, the lift frame has a set of cam surfaces engageable with a set of cam surfaces on the rail car cover to guide the lift frame into an alignment position on the cover from a predetermined position close thereto, any required limited amount of movement of the lift frame relative to the shift frame being permitted by the flexible suspension elements. The means for engaging the cover is properly positioned with respect to the cover by movement of said sets of cam surfaces into engagement position during lowering of the lift frame onto the cover. The cam surfaces of the cover may be portions of stacking pads which permit stacking of the covers one upon another in spaced relationship with the stacking pads of each cover engaging those of an adjacent cover in a stack. The means for engaging the cover may comprise spaced pins slidably mounted on the lift frame for engagement in lifting loops on the cover.

Where the carriage is mountable on a fork-lift truck, the carriage may include a pair of spaced parallel open-ended beams into which the forks of the fork-lift truck can be inserted for raising and lowering the carriage with raising and lowering respectively of the forks of the fork-lift truck. The shift frame may include a main beam slidably mounted in bearings carried by the carriage beams.

The means for effecting transverse sliding movement of the shift frame relative to the carriage may include a fluid pressure operated cylinder assembly connected to the shift frame and to the carriage. Similarly, the means mentioned above for engaging the cover may also include fluid pressure operated cylinder assemblies carried by the lift frame for effecting movement of the spaced pins.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of lifting apparatus mounted on a fork-lift truck and positioned for removing a cover from a rail car:

Figure 2 is a front view of the shift frame and lift frame of the lifting apparatus with some parts being omitted for clarity:

Figure 3 is a side view of the lift frame showing one of its cross beams aligned with the stacking pads of a cover on a rail car;

Figure 4 is a plan view of the shift frame and carriage of the lifting apparatus; and

Figure 5 is a plan view of the lift frame of the lifting apparatus.

Referring to the drawings, lifting apparatus 10 for lifting covers of open top rail cars includes a carriage 12 having a pair of spaced, parallel, hollow beams 24 connected adjacent opposite ends by cross members 20, 22. The beams 24 are spaced apart a distance equal to the spacing between the forks of a conventional lift truck, and are open-ended at the rear so that the lift truck forks can be inserted therein. The cross member 20, which is adjacent the open ends of the beams 24, has legs 26 at opposite ends to provide support for the rear end of the carriage 12 of the apparatus when it is not in use.

Two sleeve bearings 28 are mounted on the beams 24 near the front end of carriage 12 for supporting the main beam 30 of a shift frame 14, the main beam 30 being slidably mounted in the bearings 28.

A central cross beam 36 is secured to the main beam 30 at its mid-point and extends horizontally on both sides of the main beam 30. A hydraulic cylinder 32 is mounted on one beam 24 of carriage 12, and a piston rod 34 extending from cylinder 32 is connected to the central cross beam 36 of the shift frame 16 to provide controlled lateral movement of the shift frame 14 relative to the carriage 12. At each end of the main beam 30 of the shift frame 16, there is a cross beam 38 which also extends horizontally on both sides of the main beam 30. The central cross beam 36 is slightly longer than the end cross beams 38, as can be seen from Figure 4. Lugs 40 on the under side of each end of cross beam 36, and lugs 42 on the under side of each end of each cross beam 38 are provided for the removable attachment of six chains from which lift frame 16 is suspended, as will be described in more detail later.

Lift frame 16 has a main beam 44, a centrally located cross beam 46 which extends on each side of the main beam 44, and a cross beam 48 at each end which extends on each side of the main beam 44. As can be seen from Figure 5, end cross beams 48 are considerably longer than centre cross beam 46. From Figures 4 and 5, it can be seen that centre cross beam 36 of shift frame 14 is equal in length to centre cross beam 46 of lift frame 16.

Lugs 50 and 52 for chain support of lift frame 16 below shift frame 14 are respectively attached near the ends on top of cross beam 46 and on top of main beam 44 on each side of cross beam 46. Six short chains, represented in part by chains 54 in Figure 2, connect lift frame lugs 50 to shift frame lugs 40, and lift frame lugs 52 to shift frame lugs 42 to suspend lift frame 16 a few inches below shift frame 14. The chains connecting two lugs 42 to a single lug 52 are inclined to each other at an angle about 45° to inhibit lateral

movement of the lift frame 16 relative to the shift frame 14. This suspension permits minor horizontal adjustments of the position of the lift frame 16 without moving the fork lift truck, compensates for uneven ground by providing for minor vertical misalignment and, because of the arrangement of the chains, permits only limited sway during movement of the fork-lift truck.

On the underside of main beam 44 of the lift frame 16, near each end, are means 56 for engaging spaced lifting loops 58 attached to the top of an arched rail car cover 60. Each engaging means 56 includes a hydraulic cylinder 62 operable to move a pin 64 across a gap between spaced sleeves 66,68 secured to the main beam 44, the pin 64 being slidable in the sleeves 66,68. The hydraulic cylinders 62, as well as the previously mentioned hydraulic cylinder 32, are readily connectable by hydraulic connections to a source of hydraulic pressure and appropriate controls on the fork-lift truck so that the operation of the hydraulic cylinders 62 and the hydraulic cylinder 32 can be controlled by the operator of the fork-lift truck.

In order to make the lift frame 16 more rigid, a rod 70 passes from one end of the main beam 44 to the other over pillars 74 mounted on the main beam 44, opposite ends of the rod 70 being attached to lugs 72 at opposite ends of the main beam 44.

Near each end of each outer cross beam 48, supports 76 extend downwardly and carry horizontal plates 78 at their lower ends. A stacking pad engaging cup 80 is bolted to the underside of each plate 78. Each cup 80 has a cam surface in the form of a concave recess 82 which matches a cam surface in the form of a convex face portion 84 of one of four stacking pads 86 mounted on the upper side of car covers 60. These cam surfaces are preferably spherically contoured. Each of the four cups 80 on lift frame 16 is adjustably mounted on the respective plate 78 so that the set of cups 80 is aligned to give simultaneous engagement with the four stacking pads 86. Four vertical posts

88, one at each end of each outer cross beam 43, are sufficiently long to support the lift frame 16 on the ground without cups 80 contacting the ground.

As shown in Figure 3, rail car cover 60 has flanges 92 which rest on the top of car side walls 94. Flanges 92 are provided with means to secure the cover 60 to the car side walls 94, for example, slots (not shown) through which the heads of spring-loaded bolts mounted on the rail car side wall may pass before being turned at right angles to a locking position. Each cover 60 is also provided with a set of stacking pads 98 attached to the underside of the cover and aligned with the upper stacking pads 86 to provide stable support for a plurality of covers in a stack. Figure 3 also shows reinforcement ribbing 100 which extends transversely across each cover 60 in line with each pair of stacking pads 86 to give the cover 60 greater stability during handling.

When not in use, lift frame 16 of the lifting apparatus is supported on the ground by vertical posts 88 with the front end of carriage 12 resting on the main beam 44 of the lift frame 16 and the rear end of carriage 12 being supported by legs 26. To remove a cover from a rail car, a fork lift truck is manoeuvered to guide the forks 25 of the truck into carriage beams 24, as indicated in Figure 2. The forks of the lift-truck are then raised to lift carriage 12 and shift frame 14, first extending the chains 54 and then raising the lift frame 16 off the ground. The lift truck forks are raised to a height sufficient to enable the lift frame 16 to clear the top of the cover 60 on the rail car. The lift truck operator then guides the lift truck visually to a position near the centre of the rail car, with the lift frame 16 suspended over the car cover 60 and with pad-engaging cups 80 approximately positioned above corresponding stacking pads 86 on the cover 60. If the

cam surfaces 82 and 84 are not aligned to provide easy engagement on lowering of the lift frame, he then activates hydraulic cylinder 32 to move shift frame 14 to the right or to the left of the fork-life truck to improve longitudinal alignment, relative to the rail car, of the pad-engaging cups 80 with the stacking pads 86. At the same time, lateral alignment of the cups relative to the car can be improved by moving the lift truck backwards or forwards. When the lift frame is in this predetermined position selected by operator judgment for cam engagement, the operator lowers the forks of the lift truck to permit cam surfaces 82 to move on cam surfaces 84 to bring pad engaging cups 80 onto the stacking pads 86.

Limited freedom of movement of the lift frame 16 provided by the chain suspension will permit the lift frame 16 to move a small distance either longitudinally or laterally relative to the rail car to correct minor alignment errors, without movement of the remainder of the lifting apparatus. Such movement, as the lift frame is lowered, enables pad engaging cups 80 to seat properly on the stacking pads 86 with the mutually engaging surfaces of the pad engaging cups 80 and the stacking pads 86 acting as cam surfaces to guide the lift frame 16 into the required position relative to the cover 60. Cups 80 and face portions 84 are preferably spherically contoured.

The covers 60 of open top rail cars are relatively large, for example, about 50 feet long and 10 feed wide. It is consequently difficult for the lift truck operator to correctly position the fork lift truck on the first attempt so that the pad-engaging cups 80 are within the one or two inches of alignment with the stacking pads 86 on the cover needed to get mating engagement on lowering the lift frame. With the lifting apparatus of the present invention, the lift truck operator can

easily reduce longitudinal misalignment of up to one foot to a distance within one or two inches of alignment, i.e. move the lift frame to the predetermined position, after a single approach to the side of the car by activating hydraulic cylinder 32. Lateral misalignment, across the width of the car, is easily taken care of by moving the lift truck forwardly or rearwardly. Trial and error location of the truck at the centre of the car, by backing the truck and approaching in new positions with resulting requirement for lateral realignment with each adjustment of longitudinal alignment, is avoided. Any small remaining misalignments after movement of the shift frame and simple advancing or retreating of the truck on one line are easily taken care of by the movement allowed by the stabilized suspension by short chains 54 of lift frame 16 from shift frame 14. Chains which are only a few inches long permit cups 80 to move horizontally from the predetermined position within the one or two inch range of stacking pad surfaces to alignment of cam surfaces which assures mating engagement as the apparatus is lowered to place the weight of the lift frame on the stacking pads.

During the previously described operation, the forks of the fork lift truck are lowered only to such an extent that the chains 54 slacken and the cover 60 supports the weight of lift frame 16. The truck forks are not lowered to an extent that would impose the weight of carriage 12 and shift frame 14 on lift frame 16 and thence on the cover 60. The short chain suspension of the lift frame 14 also provides operating leeway that permits rapid placement of the lift frame 16 without damaging the cover 60. This chain suspension also compensates for uneven ground conditions. For example, if because of tilting of the fork lift truck relating to the rail car, the four stacking pads 86 are not

contacted simultaneously as the lifting apparatus is lowered, excessive loading will not be imposed on those pads 86 first contacted.

Seating of the pad-engaging cups 80 on the cover stacking pads 86 results in cover lifting loops 58 being positioned between respective sleeves 66,68 on the lift frame 16. The operator then activates hydraulic cylinders 62 to move lifting pins 64 from withdrawn positions into closure positions passing through lifting loops 58 and entering sleeves 68. The forks of the fork lift truck are then raised to raise the lifting apparatus thereby lifting the cover 60 from the rail car. The fork lift truck is then moved, with the cover 60, to a convenient place, for example a stack of covers. After proper positioning of the lift truck and actuation of the hydraulic cylinder 32, if necessary, the lifting apparatus is lowered until the lower stacking pads 98 on the cover 60 engage the stacking pads 86 of the uppermost cover of the stack with the covers in spaced relation to one another. Hydraulic cylinders 62 are then actuated to withdraw the pins 64 from the lifting loops 58.

When placing a cover 60 on a rail car, the operations desired above are essentially reversed. A cover 60 is removed from a stack in much the same manner as it was lifted from a rail car, and transported to a position above a rail car with cover flanges 92 aligned with the car side walls 94. If required, the operator makes lateral and longitudinal adjustments as before except that, instead of bringing pad engaging cups 80 into close alignment with stacking pads 86, the cover flanges 92 are brought into close alignment with the car side walls 94 to permit engagement of closure bolts, for example, the previously mentioned spring-loaded bolts, with the cover flange slots.

Because of the shortness of the chains 54 by which the lift frame 16 is suspended from the shift frame 14, a cover 60 carried by the lift frame 16 cannot move relative to the fork lift truck by an excessive amount. This reduces the risk of damage to the cover 60 when the fork lift truck traverses rough ground, for example rail track crossings, when moving the cover 60 from one place to another. It also reduces the risk of damage to the cover 60 in a strong wind, since the wind cannot move the cover 60 an unduly large amount while the cover 60 is carried by the fork lift truck.

The lifting apparatus may also be provided with chains and hooks to handle covers that do not have stacking pads which mate with the pad-engaging cups 80 of the apparatus. These chains may be attached at one end to lugs 90 on vertical corner posts 88, with hooks being provided on the other ends for anchoring to cover flanges. This arrangement is more convenient than bringing in separate equipment when mixed style covers are used in a single train. When these auxiliary chains and hooks are not in use, it is convenient to drop these chains into the hollow posts 88 and hang the hooks onto the upper ends of the posts.

Also, if desired, a safety chain may be used to secure the carriage 12 to the fork frame of the fork lift truck to prevent the carriage 12 from slipping off the truck forks during travel of the lift truck.

The advantages of the invention are clearly apparent from the foregoing description of the preferred embodiment of the invention. Other embodiments of the invention will be readily apparent to one skilled in the art, the scope of the invention being defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Lifting apparatus for placing an elongated cover on an elongated open top rail car and removing a cover therefrom, said apparatus comprising a carriage mountable on a movable vehicle for raising and lowering thereby, a shift frame slidably mounted on the carriage for transverse sliding movement relative thereto, means for effecting said transverse sliding movement of the shift frame relative to the carriage, an elongated lift frame suspended from the shift frame and extending transversely thereof, said lift frame having means for engaging an elongated rail car cover to enable the cover to be raised and lowered by the raising and lowering respectively of the carriage by the movable vehicle.

2. Lifting apparatus according to Claim 1 wherein the elongated lift frame is suspended from the shift frame by flexible suspension elements permitting a limited amount of relative movement between the lift frame and the shift frame.

3. Lifting apparatus according to Claim 2 wherein said flexible suspension elements are relatively short so as to permit a small amount of movement of the lift frame relative to the shift frame only sufficient to accommodate a small initial misalignment of the lift frame with a rail car cover caused by a slightly inaccurate initial positioning of the movable vehicle relative to the cover.

4. Lifting apparatus according to Claim 2 wherein the lift frame has cam surfaces engageable with cam surfaces on the rail car cover to guide the lift frame into a predetermined position on the cover with a consequent limited amount of movement of the lift frame relative to the shift frame being permitted by the flexible suspension elements.

5. Lifting apparatus according to Claim 4 wherein the means for engaging the cover is properly positioned with respect to the cover by relative movement between said cam surfaces during lowering of the lift frame onto the cover.

6. Lifting apparatus according to Claim 5 wherein said cam surfaces of the cover are constituted by stacking pads enabling stacking of covers one upon another in spaced relation with the stacking pads of each cover engaging an adjacent cover in a stack.

7. Lifting apparatus according to Claim 5 wherein the means for engaging the cover comprise spaced pins slidably mounted on the lift frame for engagement in lifting loops on said cover.

8. Lifting apparatus according to Claim 1 wherein the carriage is mountable on a fork-lift truck, said carriage including a pair of spaced parallel open-ended beams into which the forks of the fork-lift truck can be inserted for raising and lowering the carriage with raising and lowering respectively of the forks of the fork lift truck.

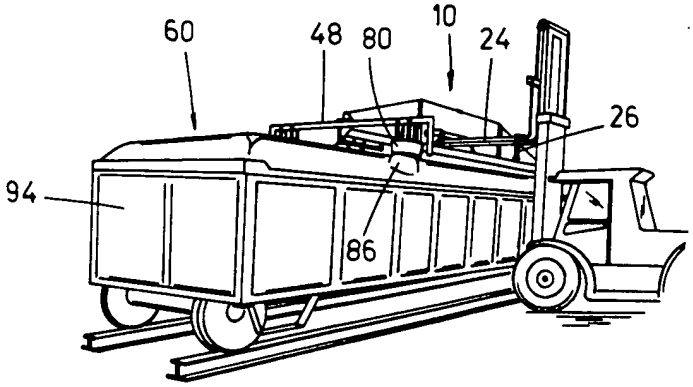
9. Lifting apparatus according to Claim 8 wherein the shift frame includes a main beam slidably mounted in bearings carried by the carriage beams.

10. Lifting apparatus according to Claim 1 wherein the means for effecting transverse sliding movement of the shift frame relative to the carriage includes a fluid pressure operated cylinder assembly connected to the shift frame and to the carriage.

11. Lifting apparatus according to Claim 7 wherein the means for engaging the cover also includes fluid pressure operated cylinder assemblies carried by the lift frame for effecting sliding movement of the spaced pins.

2-1

FIG. 1



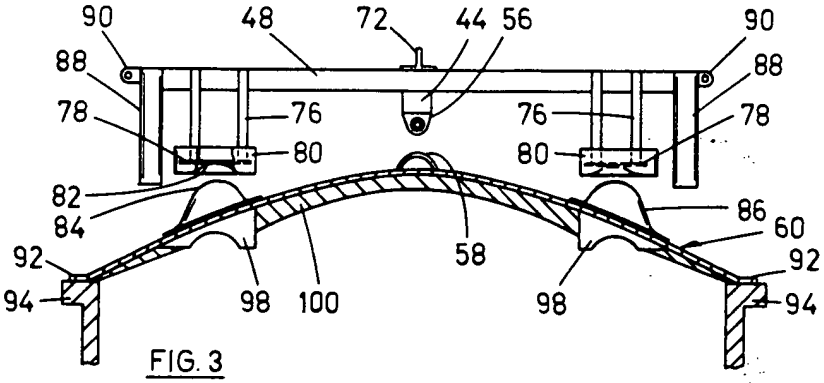


FIG. 3

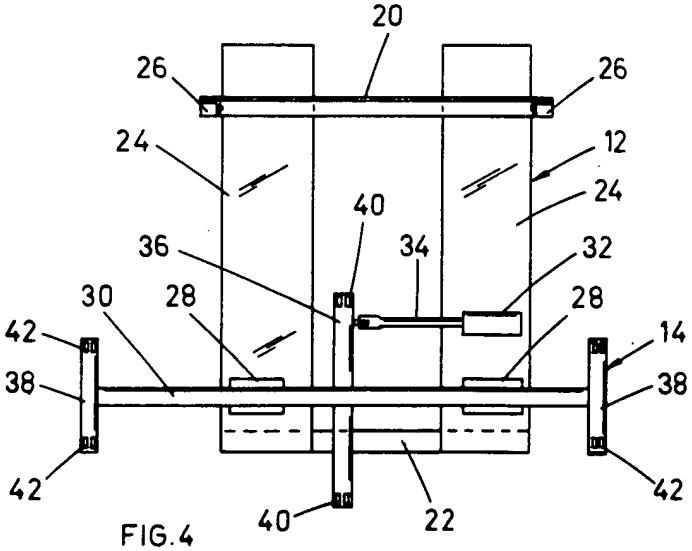


FIG. 4

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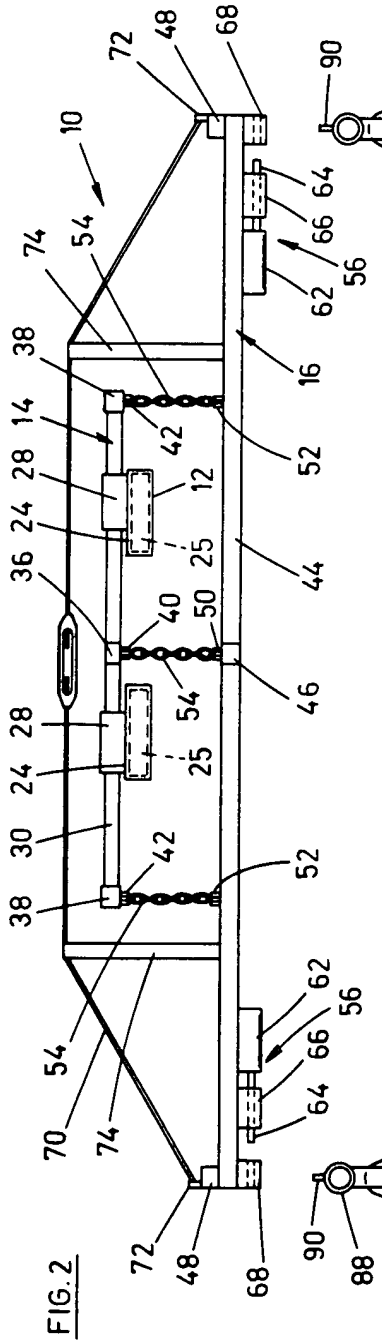

FIG. 2

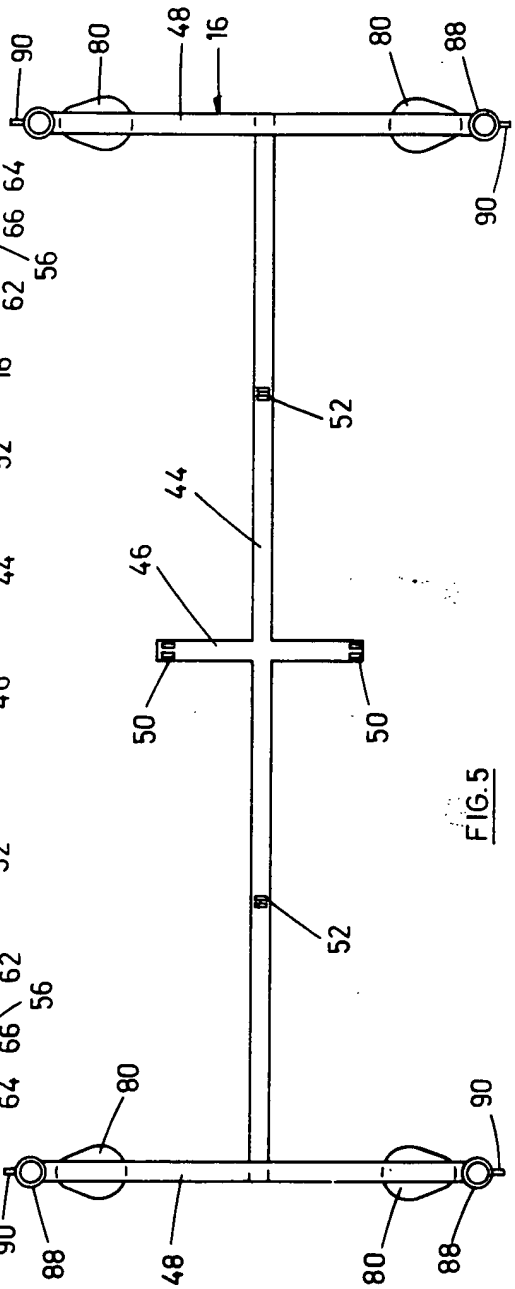

FIG. 5

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